PHYS 1441 – Section 004
Lecture #1

Wednesday, Jan. 21, 2004

Dr. Jaehoon Yu

- Who am I?
- How is this class organized?
- What is Physics?
- What do we want from this class?
- Brief history of physics
- Chapter one
  - Uncertainties and Significant Figures
  - Standards and units
  - Estimates
  - Unit conversions

Today's homework is homework #1, due 1pm, next Wednesday!!

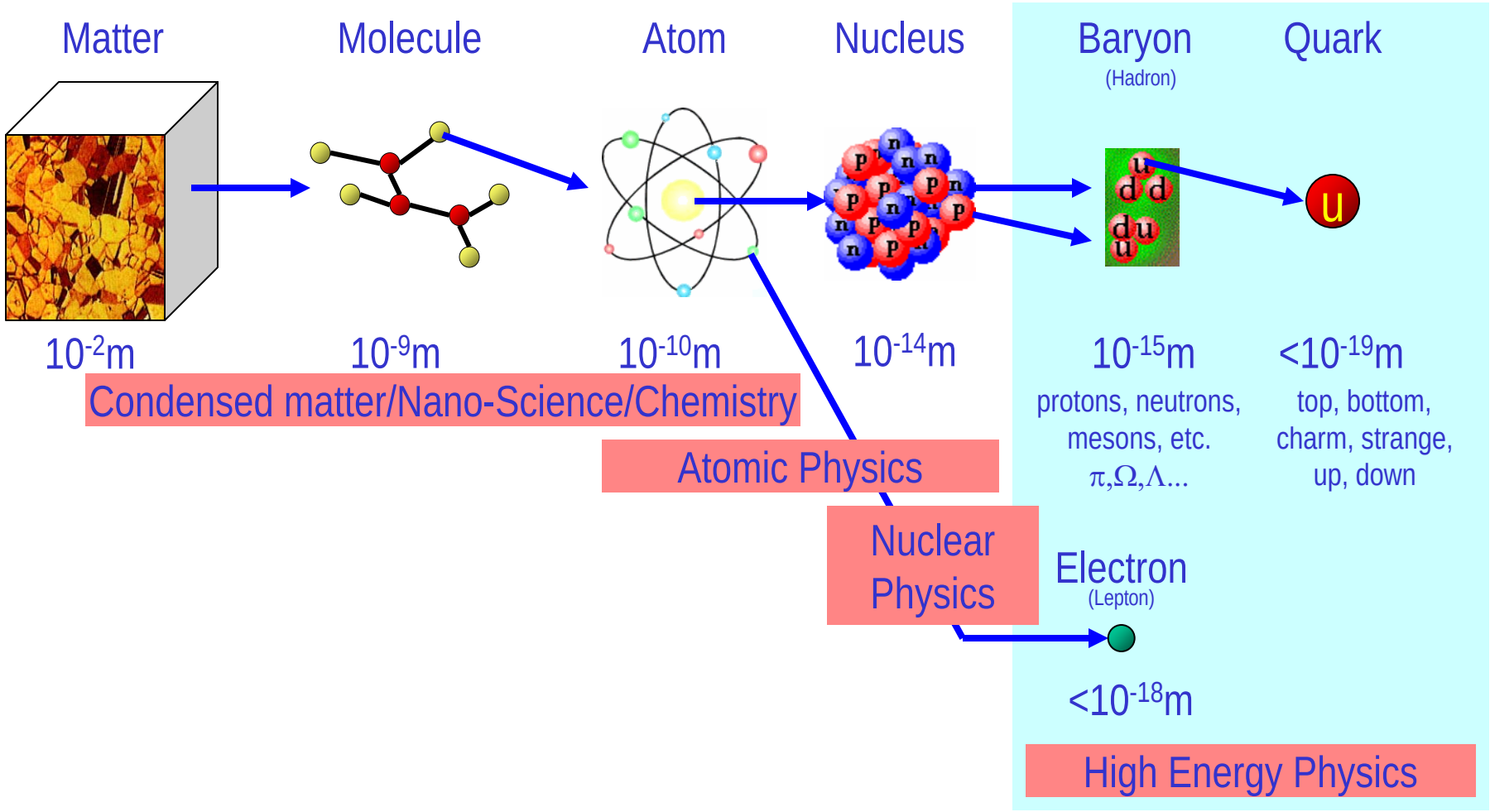
Announcements

- Reading assignment #1: Read and follow through Appendix sections by Wednesday, Jan. 28
  - A-1
  - A-2
  - A-3
  - A-4
- There will be a quiz on Wednesday, Jan. 28

Who am I?

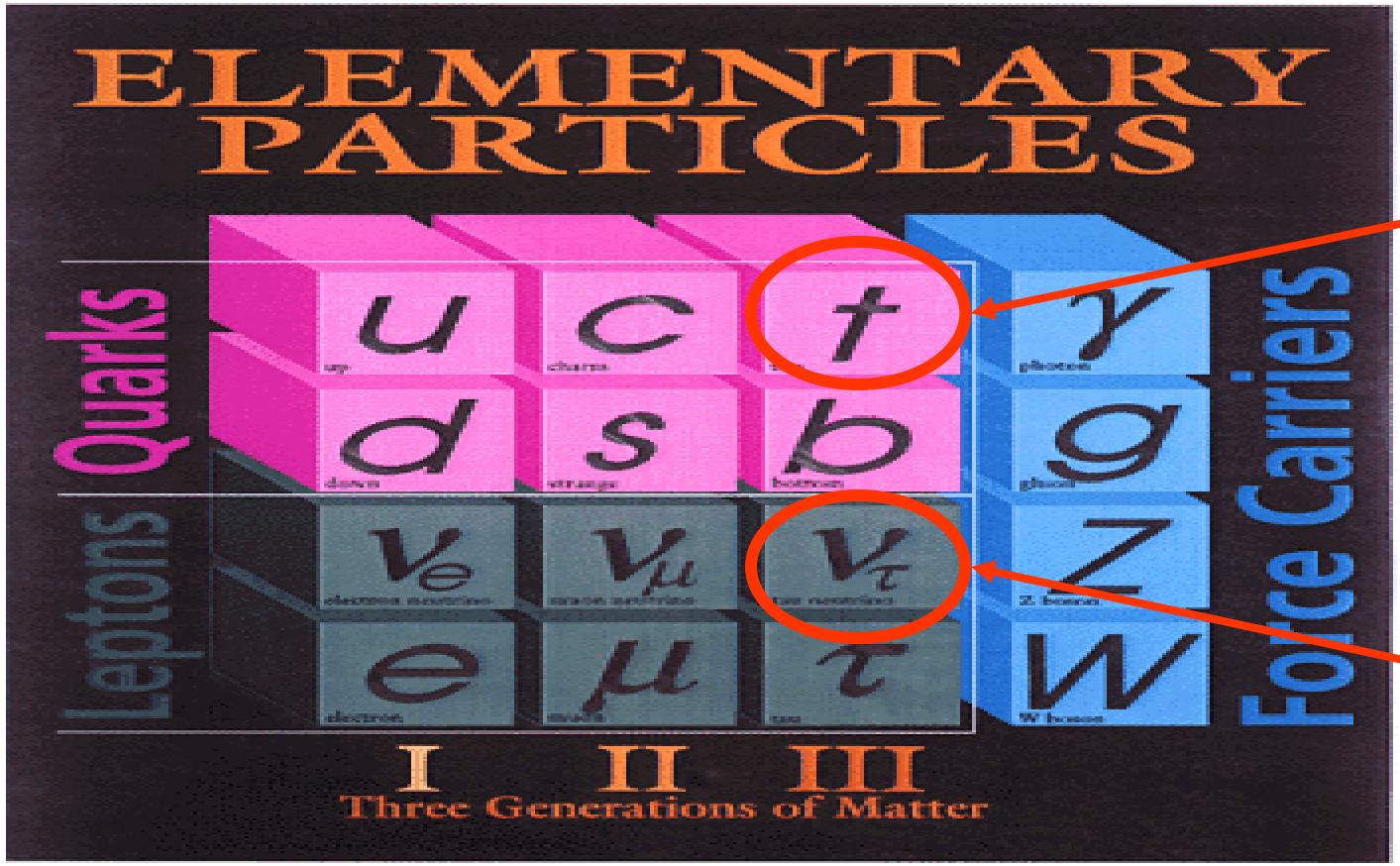
- Name: Dr. Jaehoon Yu (You can call me Dr. Yu)
- Office: Rm 242A, Science Hall
- Extension: x2814, E-mail: *jaehoonyu@uta.edu*
- My profession:High Energy Physics (HEP)
  - Collide particles (protons on anti-protons or electrons on anti-electrons, positrons) at the energies equivalent to 10,000 Trillion degrees
  - To understand
    - Fundamental constituents of matter
    - Interactions or forces between the constituents
    - Creation of Universe (**Big Bang** Theory)
  - A pure scientific research activity
    - Direct use of the fundamental laws we find may take longer than we want but
    - Indirect product of research contribute to every day lives; eg. WWW

Structure of Matter



The Standard Model

- Assumes the following fundamental structure:

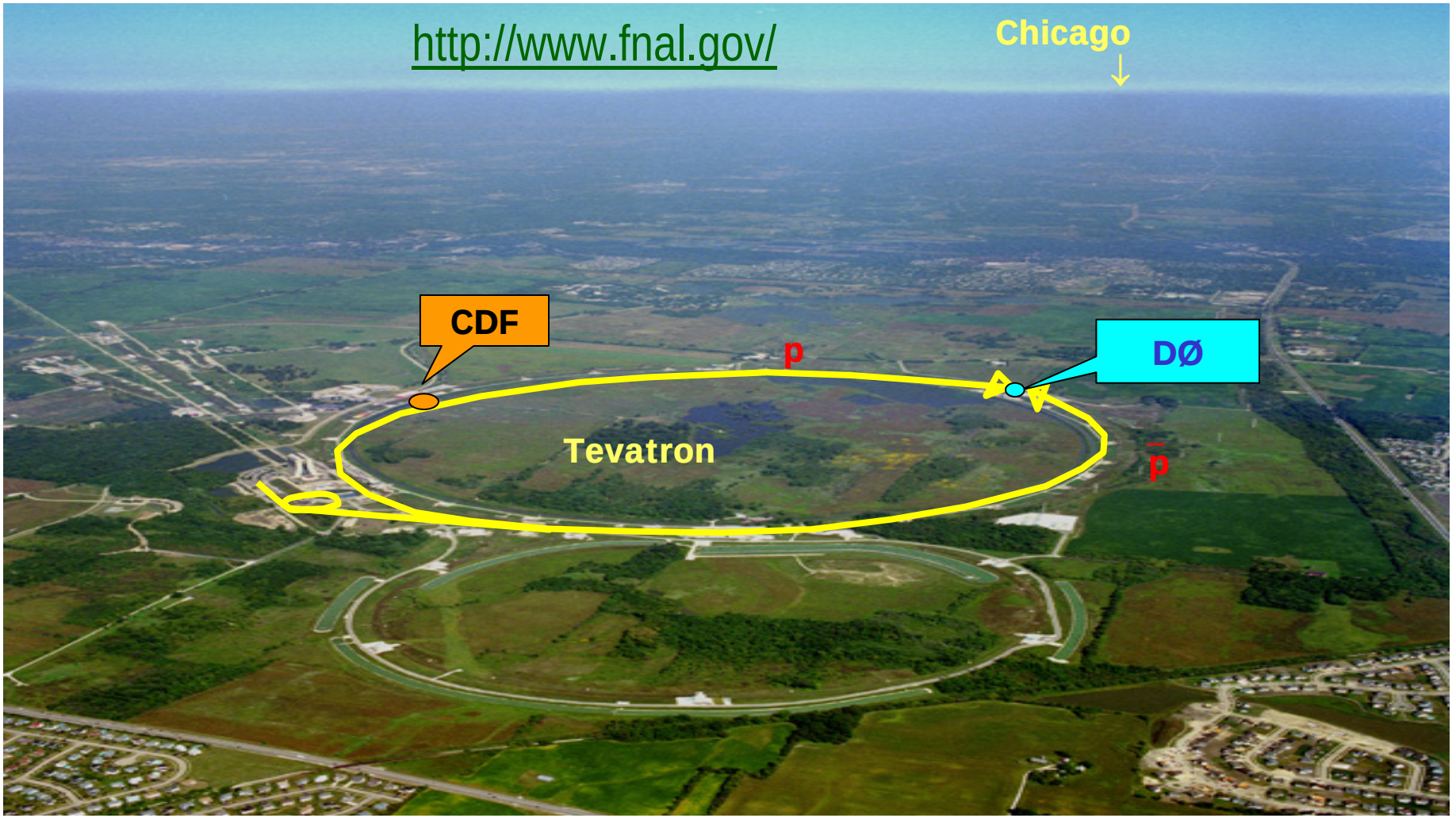


Discovered in 1995

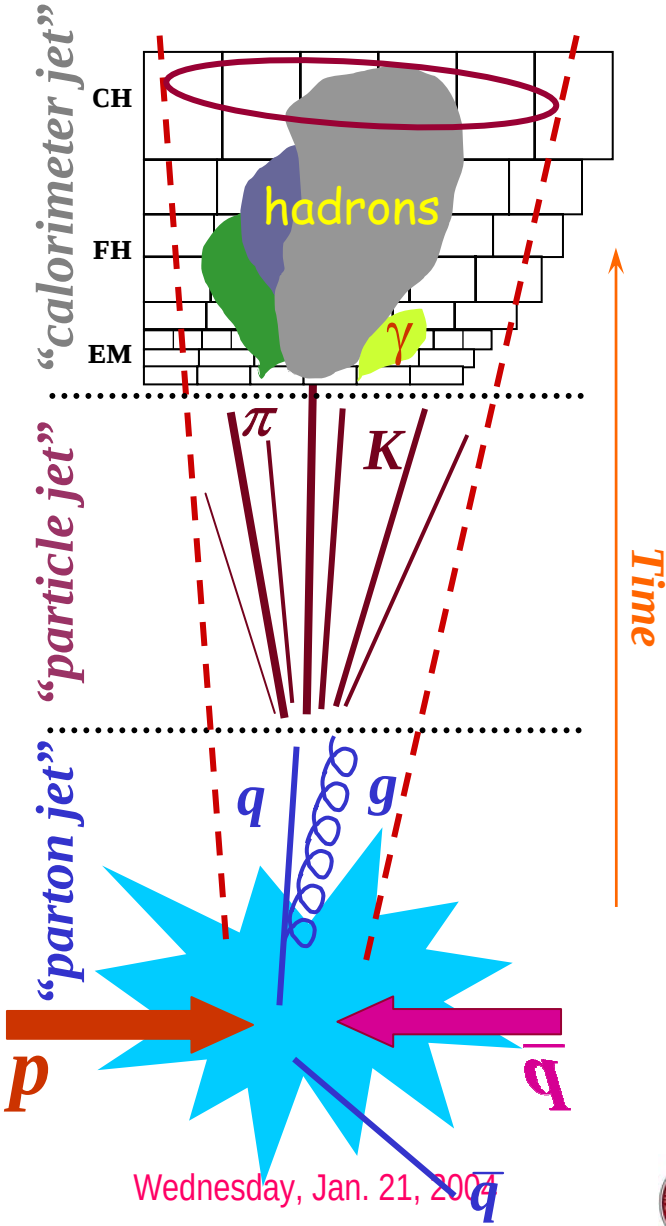
Directly observed in 2000

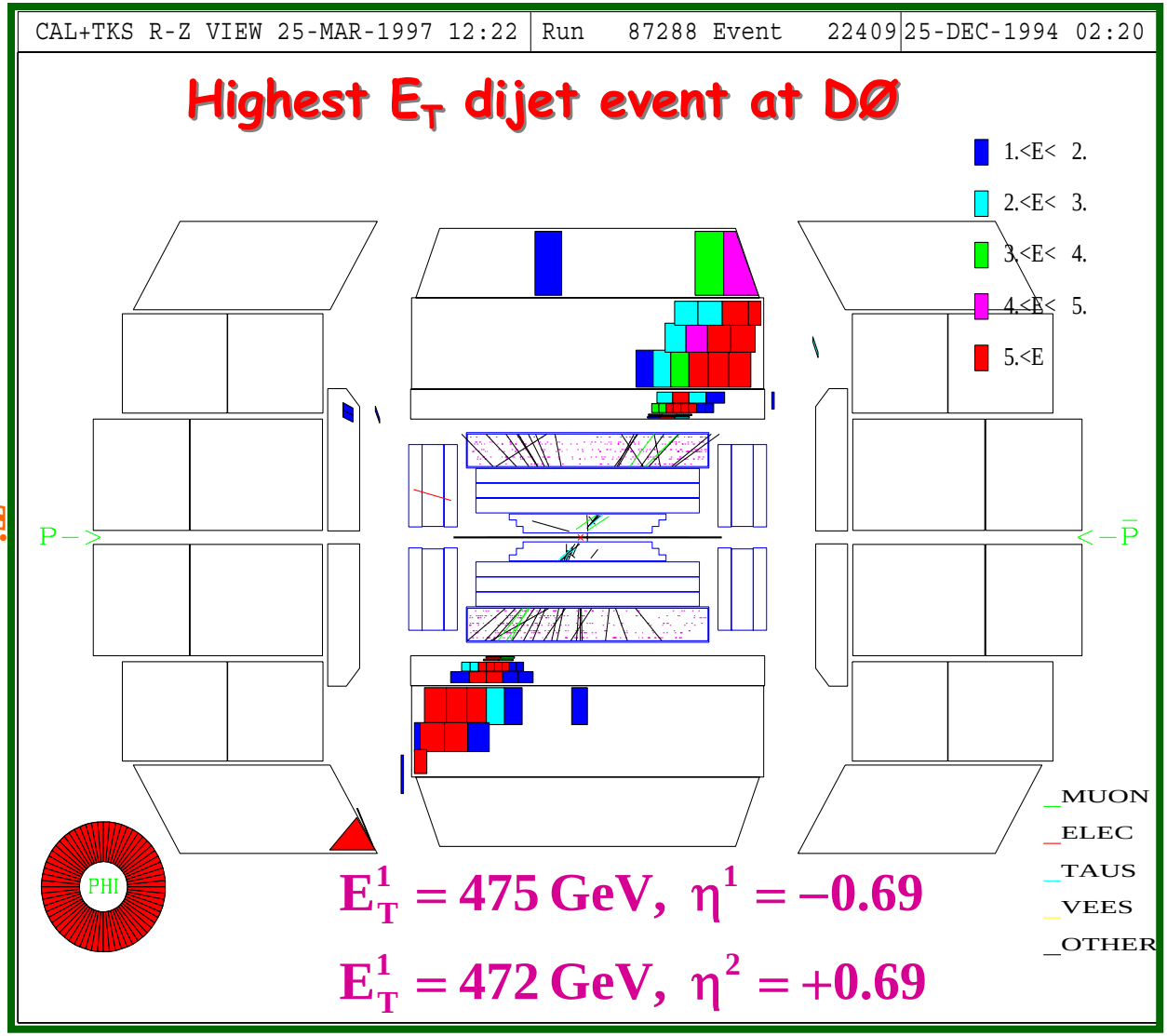
Fermilab Tevatron Accelerator

- World's Highest Energy proton-anti-proton collider
  - E_{cm}=1.96 TeV (=6.3x10^{-7}J/p➔ 1.3MJoule)
  - Equivalent to the kinetic energy of a 5 ton truck running at 100km/hr



How does an Event Look in a Collider Detector?

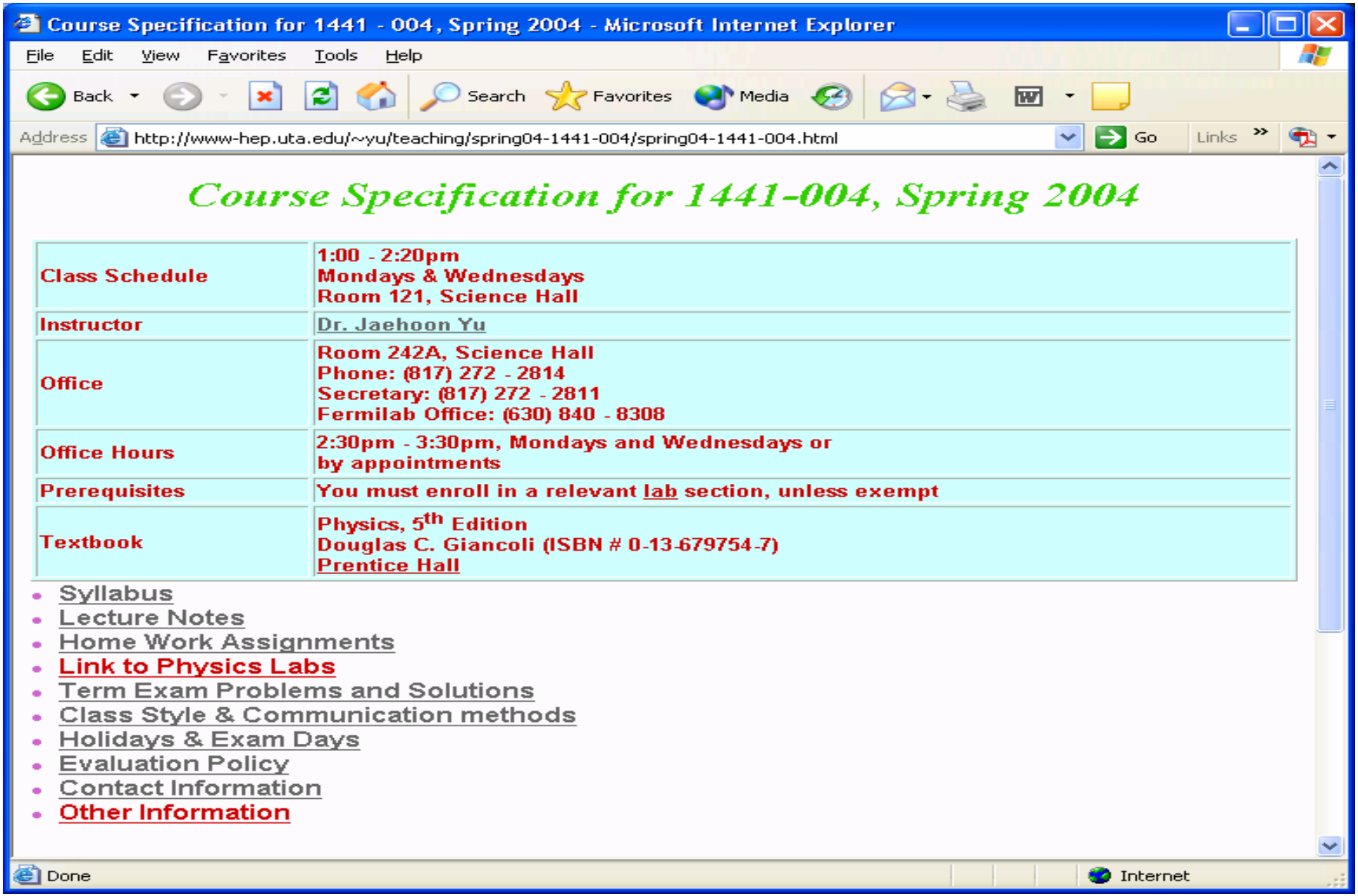




Information & Communication Source

- My web page: http://www-hep.uta.edu/~yu/
  - Contact information & Class Schedule
  - Syllabus
  - Holidays and Exam days
  - Evaluation Policy
  - Class Style & homework
  - Other information
- Primary communication tool is e-mail: Register for PHYS1441-004-SPRING04 e-mail distribution list as soon possible
  - 5 points extra credit if done by next Monday, Jan. 26
  - 3 points extra credit if done by next Wednesday, Jan. 28
  - 1 point extra credit if done by Monday, Feb. 2
- Office Hours: 2:30 – 3:30pm, Mondays and Wednesdays or by appointments

Primary Web Page



Syllabus for PHYS 1441 - 004, Spring 2004 - Microsoft Internet Explorer

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Address http://www-hep.uta.edu/~yu/teaching/spring04-1441-004/syllabus.html Go Links

Syllabus for1441-004, Spring 2004

Period	Chapters
Weeks of Jan. 21 and Jan. 26, 2004	Chapters 1 - 3: Estmiate, measurements, Describing one and two dimensional motions
Weeks of Feb. 2 and Feb. 9, 2004	Chapters 4 and 5: Newton's Law of Motion, Circular Motion, Gravitation
Week of Feb. 16, 2004	Chapters 6: Work and energy
Monday, Feb. 23, 2004	**First Term Exam (Chap. 1 - 6 to work and energy)**
Feb. 25 & Weeks of Mar. 1 and Mar. 8, 2004	Chapters 6 - 8: Energy conservation, Linear Momentum and Collisions, Rotational Motion,
Weeks of Mar. 15 and Mar. 22, 2004	Chapters 9 - 11: Bodies in Equilibrium, Fluids, Vibration and Waves
Monday, Mar. 29, 2004	**Second Term Exam (Chap 6 - 11)**
Mar. 31 & Weeks of Apr. 5 and Apr. 12, 2004	Chapters 12 - 13: Sound, Temperature and Kinetic energy
Weeks of Apr. 19 and Apr. 26, 2004	Chapters 14 - 15: Heat, Laws of Thermodynamics
Week of May 3, 2004	Remaining uncovered materials and review
Monday, May 10, 2004	**Third (Final) Term Exam (Chap. 12 - 15)**

*** The above schedule might change depending on progress in the class.*

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Done Internet

Evaluation Policy

- Term Exams: 45%
  - Total of three term exams (2/23, 3/29 & 5/10)
  - Best two of the three will be chosen
  - Each will constitute 22.5% of the total
  - Missing an exam is not permissible unless pre-approved
    - No makeup test
- Lab score: 20%
- Homework: 20%
- Pop-quizzes: 15%
- Extra credits: 10% of the total
  - Random attendances
  - Strong participation in the class discussions
  - Other many opportunities
- Will be on sliding scale unless everyone does very well

Homeworks

- Solving homework problems is the only way to comprehend class material
- An electronic homework system has been setup for you
  - Details are in the material distributed today
  - https://hw.utexas.edu/studentInstructions.html
  - Download homework #1 (1 problem), attempt to solve it, and submit it ➔ You will receive a 100% credit for HW#1
  - Roster will close next Wednesday, Jan. 28
- Each homework carries the same weight
- Home work will constitute 20% of the total ➔ A good way of keeping your grades high
- Strongly encouraged to collaborate ➔ Does not mean you can copy

Homework Assignments for PHYS 1441 - 004, Spring 2004 - Microsoft Internet Explorer

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Homework Assignments for 1441-004, Fall 2004

Since the only way to fully comprehend class material is by solving as many homework problems as possible. An electronic version of homework assignments will be given in each class. You will have to register first before you can begin working on your homework. You do not have to assign any password for this, though I strongly suggest you to do so. Go to the Home Work Assignment page and follow the instructions to first register yourself to the class roster and pickup your homework. The unique ID for this course is **41004**, and there is **no specific password** for the class. Please be sure to remember your login information and keep using them otherwise your score will not be correctly assigned.

The scores gained from the homework assignments will be taken into account 20% of the final grading. For grading purposes, worst three of the expected 23 homework assignments will be dropped. Please be careful in answering the homework assignments since there are deduction of points for those incorrectly answered.

The due for the given homework is always 1am, one week after the assignment has been given. In other words, the due for the homework assignment given on a Monday class this week is 1am of the next Monday.

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Internet

Attendances and Class Style

- Attendances:
  - Will be taken randomly
  - Will be used for extra credits
- Class style:
  - Lectures will be on electronic media
    - The lecture notes will be posted on the web AFTER each class
  - Will be mixed with traditional methods
  - Active participation through questions and discussions are STRONGLY encouraged ➔ Extra credit….

Why do Physics?

Exp.
- To understand nature through experimental observations and measurements (Research)

Theory
- Establish limited number of fundamental laws, usually with mathematical expressions
- Predict the nature's course

⇒Theory and Experiment work hand-in-hand

⇒Theory works generally under restricted conditions

⇒Discrepancies between experimental measurements and theory are good for improvements

⇒Improves our everyday lives, though some laws can take a while till we see amongst us

Models, Theories and Laws

- Models: A kind of analogy or mental image of a phenomena in terms of something we are familiar with
  - Often provides insights for new experiments and ideas
- Theories: More systematically improved version of models
  - Can provide quantitative predictions that are testable and more precise
- Laws: Certain concise but general statements about how nature behaves ➔ The statement must be found experimentally valid
- Principles: Less general statements of how nature behaves
  - Has some level of arbitrariness

What do we want from this class?

- Physics is everywhere around you.
- Understand the fundamental principles that surrounds you in everyday lives…
- Identify what law of physics applies to what phenomena and use them appropriately
- Understand the impact of such physical laws
- Learn how to research and analyze what you observe.
- Learn how to express observations and measurements in mathematical languages.
- Learn how to express your research in systematic manner in writing
- I don't want you to be scared of PHYSICS!!!

Most of importantly, let us to have a lot of FUN!!

Brief History of Physics

- AD 18th century:
  - Newton's Classical Mechanics: A theory of mechanics based on observations and measurements
- AD 19th Century:
  - Electricity, Magnetism, and Thermodynamics
- Late AD 19th and early 20th century (Modern Physics Era)
  - Einstein's theory of relativity: Generalized theory of space, time, and energy (mechanics)
  - Quantum Mechanics: Theory of atomic phenomena
- Physics has come very far, very fast, and is still progressing, yet we've got a long way to go
  - What is matter made of?
  - How do matters get mass?
  - How and why do matters interact with each other?
  - How is universe created?

Uncertainties

- Physical measurements have limited precision, however good it is, due to:

Stat.{ – Number of measurements

Syst.{ – Quality of instruments (meter stick vs micro-meter)
– Experience of the person doing measurements
– Etc

– In many cases, uncertainties are more important and difficult to estimate than the central (or mean) values

Uncertainties cont'd

- Estimated Uncertainty
  - Suppose a result of a measurement is expressed as

$$5.2 \pm 0.1 cm$$

  - The estimated uncertainty is 0.1cm.
- Percent Uncertainty: Simply the ratio of the uncertainty to the measured value multiplied by 100:

$$\frac{0.1}{5.2} \times 100 = 2\%$$

- If uncertainties are not specified, it is assumed to be one or two units of the last digit specified:
  - For length given as 5.2cm, the uncertainty is assumed to be about 0.1cm

Significant Figures

- Significant figures denote the precision of the measured values
  - Significant figures: non-zero numbers or zeros that are not place-holders
    - 34 has two significant digits, 34.2 has 3, 0.001 has one because the 0's before 1 are place holders, 34.100 has 5, because the 0's after 1 indicates that the numbers in these digits are indeed 0's.
    - When there are many 0's, use scientific notation:
      - $31400000=3.14\text{x}10^{7}$
      - $0.00012=1.2\text{x}10^{-4}$

Significant Figures

- Operational rules:
  - Addition or subtraction: Keep the smallest number of decimal place in the result, independent of the number of significant digits: 34.001+120.1=154.1
  - Multiplication or Division: Keep the smallest significant figures in the result: 34.001x120.1 = 4083, because the smallest significant figures is 4.